PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: WILLIAM RAYMOND SHERLOCK and KEITH GORDON TAIT

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COMPLETE SPECIFICATION

Improvements in Fluid Control Valves

We, SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ N.V., a company organised under the laws of The Netherlands, of 30 Carel van Bylandtlaan, The Hague, The Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is concerned with an improvement in fluid control ball valves of the kind comprising a valve body, a movable valve member which is a metal ball having a bore through it for the passage of fluid, the ball being mounted between seatings within said valve body and being movable to effect the desired control of fluid flow through the valve by movement of a valve stem (or other actuating linkage hereafter considered to be comprised within the term "stem") which is operatively connected to the ball after an initial movement of the valve stem, but is not physically, and hence, in the absence of any electrically conductive connection between the valve stem and the ball, not electrically, connected to the ball in any permanent manner. For example, a suitably shaped end of the stem is located, with clearance, within a slot in the ball in such a manner that, after an initial small rotation of the stem to bring the end of the stem into contact with the ball, further rotation of the stem will effect rotation of the ball; and the ball will normally be supported within the valve body entirely by non-metallic seatings which, by virtue of the material from which they are made, for example, "Teflon", a nylon, or a hard synthetic rubber, have a very low or negligible electrical conductivity.

Under abnormal conditions such as can occur if a fire arises in the vicinity of such a ball these non-metallic seatings may be destroyed in which case the valve when it is in the closed position can be made to "fail safe" by providing metal seat portions (which have been referred to as "guard seats") on the valve body against one or other of which metal seat portions the ball will be held after failure of the normal seatings. In convenient arrangement such metal seat portions are formed on those parts of the valve body in or against which the normal non-metallic seatings are held. In order to provide for "fail safe" movement of the ball within the valve body in addition to its normal rotational movement therein, permanent physical connection between the valve stem and the ball is eliminated and sufficient clearance is provided between the valve stem and the ball to permit this movement to take place. The problem which might then arise with such a valve is that in normal operation the ball can become electrically charged as the result of fluid through its bore and that any such electrical charge can be suddenly discharged to the valve body or a part thereof, for example, a metal seat or the valve steam. Such discharge of a static electrical charge within the valve could result in the ignition of an ignitable fluid within the valve.

According to the present invention a fluid control valve comprises a valve body, a valve member which is a metal ball having an axial bore being normally mounted between electrically non-conductive seatings in the valve body and being moveable through at least 90° in a plane containing the axis of said bore, a valve stem the lower end of which is disposed within a recess or slot in the ball

[*Price 4s. 6d.*]

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in such a manner as to be operatively connectable to move said ball without being physically connected thereto in a permanent manner, and an electrically conducting spring or brush housed in a bore in either the valve body or the valve stem in permanent electrical connection with said valve body, an end of said spring or brush contacting said valve member in all positions in which said valve member can be located within said valve body to provide a permanent electrical connection between the valve member and the valve body, the said electrically conducting spring normally providing the sole means of electrical connection between the valve body and valve member when the valve stem is not in physical contact with the valve member. A helical spring is preferred, but another form of spring or a spring-loaded brush (the term brush being used in its electrical sense) housed in a bore as stated above, can also be employed to provide the required electrical connection in a valve in accordance with the present invention.

Preferably such a valve comprises a helical spring housed within a bore in said valve stem or in a bore in the valve body located in such a manner that an end of the spring bears against the surface of the ball, for example, in a position which is diametrically or approximately diametrically opposite the lower end of said valve stem. The spring can be either an interference fit or a sliding fit in an axial bore (the term " bore " including a drilling) in said valve stem; and, in the case of a drilling extending the length of said valve stem, the spring is conveniently retained therein by a screw inserted in to a threaded portion of the drilling at its end remote from the ball. Alternatively, the spring can be housed in a threaded or partly-threaded bore in the valve body, the spring being retained by a retaining screw which also closes the bore in a fluid-tight manner. Advantageously contact between said spring and the valve member, for example, said ball, takes place through permanent point or line contact at an end of said spring which is of such a size and shape as to give rise to a " self-cleaning " scraping action between said spring and said valve member whenever relative movement occurs between said spring and said valve member, for example, the ball.

The present invention is illustrated, by way of example, by the following two embodiments of the invention which will be described with reference to the accompanying diagramatic drawings, in which:—

Figure 1 is a perspective view, partly in section to show the ball and operating stem, of a form of " fire-safe " ball valve,

Figure 2 is a part-sectional view, taken on the line 2—2 of Figure 1 in the direction of the arrow X, of part of the ball and operating stem of the valve, the operating stem embodying an electrical connection in accordance with the present invention,

Figure 3 is a part-sectional view, also taken on the line 2—2 of Figure 1 but in the direction of the arrow Y, showing an alternative disposition of electrical connection in accordance with the present invention, and

Figure 4 is a detailed view on an enlarged scale of the electrical connection employed in the valve of Figure 3.

Referring to Figure 1 of the accompanying drawings a straight-through ball valve having provision for bleeding fluid from it comprises a valve body 10 having inlet and outlet ports 11, 12 on a common axis, each port being shouldered to provide " fire-safe " metal seat portions 13. A non-metallic seating 14 of, for example, " Teflon " is provided in front of each of these metal seat portions 13 and the seatings 14 together constitute the normal operational seatings of the valve. A movable valve member comprising a metal ball 15 having an axial bore 16, which is conveniently 2 inch in diameter, is located between the seatings 14 in such a manner as to be rotatable between open and shut positions of the valve, rotational movement being imparted thereto by rotation of a valve stem 17 of circular cross-section which is mounted in any suitable fluid-tight manner in the valve body 10 and is electrically connected thereto. The end 18 of the valve stem 17 is machined to fit within a slot 19 in the ball 15. As shown in Figure 1, the circular cross-section of the valve stem 17 is milled to form a short integral extension 18 of rectangular cross-section which fits with clearance within the slot 19 in the ball 15, but it is also possible for the end 18 of the stem 17 to have a flat milled on one side only to enable the end 18 to fit with clearance within the slot 19 in the ball 15. In both cases an operational connection is provided for between the ball 15 and the valve stem 17, whilst allowing for the limited freedom of movement of the ball 15 with respect to the stem 17 which is required if the ball 15 is to " fail safe " i.e. to move up to one or other of the metal seat portions 13 following failure of the respective non-metallic seatings 14.

Referring to Figure 2, the shaped end 18 of the valve stem 17 is drilled to provide a bore 20, for example, 9/16 inch long and $\frac{1}{8}$ inch in diameter, for housing a helical spring 21. For the bore dimensions just quoted the spring 21 can have a free overall length of $\frac{5}{8}$ inch. The spring 21 is conveniently an interference fit with the bore 20, and projects therefrom about 1/16 inch so as to bear with line or point contact against the surface of the ball 15 within the slot 19, the stiffness of the spring being such as to establish a permanent electrical connection between the ball 15 and the stem 17, (and hence the valve body 10 since the stem 17

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is permanently electrically connected therewith), which has a degree of self-cleaning action during movement of the stem 17 with respect to the ball 15 without impairing the necessary "fail safe" free movement of the ball 15 with respect to the stem 17.

In the valve just described a bleed outlet 22 is usually fitted to the valve body 10, in a position with respect to the ball 15 which is diametrically opposite the valve stem 17, for bleeding fluid from the valve in conventional manner. If desired, bore 20 in the valve stem 17 can extend as a drilling through the length of the stem 17 to enable the spring 21 to be inserted in, or withdrawn for period inspection from, an assembled valve. In such case the spring 21 can be a sliding fit in the drilling; and the spring 21 is conveniently attached to one end of a retaining screw adapted to retain the spring in position and also to close the upper end of the drilling in a fluid-tight manner.

Referring to Figures 3 and 4 of the accompanying drawings, in an alternative form of fluid control valve in acordance with the present invention the bleed outlet 22 (Figure 1) is dispensed with (in many instances, for example, in the case of a small valve, the bleed outlet 22 may not be required) and a coil spring 23 as described above is fitted in the valve body 10 instead of in the bore 20 in the valve stem 17. In this embodiment the valve body 10 is provided with a housing for the coil spring 23 which comprises a bore 24 extending through to the interior of the valve. The bore 24 is internally threaded for the reception of a short retaining screw 25 which holds the coil spring 23 in a position in which the free end of the spring 23 projects a short distance from its housing (i.e. the bore 24) to bear against the ball 15 to provide the required permanent electrical connection between the ball 15 and the valve body 10. This alternative form of the present invention has the advantage of enabling the present invention to be applied to small ball valves in which, because of the small ball size, the slot (19) in the ball (15) extends through to its bore.

An advantage of using a coil spring in the manner described in either of these specific embodiments of the present invention is that its presence in undamaged form can be checked easily by withdrawing either the valve in stem or the coil-retaining screw as appropriate, whereas more extensive dismantling of the valve (including removal from the line in which it is fitted) would be necessary if a spring, e.g. a simple leaf spring, were provided on the ball itself. A further advantage of the present invention is that the line contact provided by the end turn of the coil spring (or alternatively the point contact provided by a relatively sharp cut-off end of the coil spring) which bears against the ball tends to be self-cleaning. This is particularly advantageous when the fluid passing through the valve is such as to tend to deposit or build-up on surfaces with which it comes into contact, e.g. an organic high polymer in solution or finely-powdered form (which in suspension in a carrier gas behaves as a fluid).

It will be appreciated that the present invention can be applied to a large variety of valves in which there is a movable valve member (as herein defined) which, in the absence of the invention, would be or could become isolated electrically from the rest of the valve (herein referred to as the valve body) and consequently susceptible to the build up of a static electrical charge.

WHAT WE CLAIM IS:—

1. A fluid control valve comprising a valve body, a valve member which is a metal ball having an axial bore being normally located within electrically non-conductive seatings in the valve body and being moveable through at least 90° in a plane containing the axis of said bore, a valve stem the lower end of which is disposed within a recess or slot in the ball in such a manner as to be operatively connectable to move said ball without being physically connected thereto in a permanent manner, and an electrically conducting spring or brush housed within a bore in either the valve body or the valve stem in permanent electrical connection with said valve body, an end of said spring or brush contacting said valve member in all positions in which said valve member can be located within said valve body to provide a permanent electrical connection between the valve member and the valve body, the said electrically conducting spring normally providing the sole means of electrical connection between the valve body and valve member when the valve stem is not in physical contact with the valve member.

2. A fluid control valve as claimed in claim 1, wherein the electrically conducting spring is a helical spring whose end is of such a size and shape as to give rise to a "self-cleaning" scraping action between said spring and said valve member whenever relative movement occurs betwcn said spring and said valve member.

3. A fluid control valve as claimed in claim 1 and constructed in any manner hereinbefore described.

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4. A fluid control valve substantially as hereinbefore described with reference to Figure 1 and 2 or 1, 3 and 4 of the accompanying drawings.

WILLENS & ROBBINS
Chartered Patent Agents,
Shell Centre,
London, S.E.1.
Agents for the Applicants.

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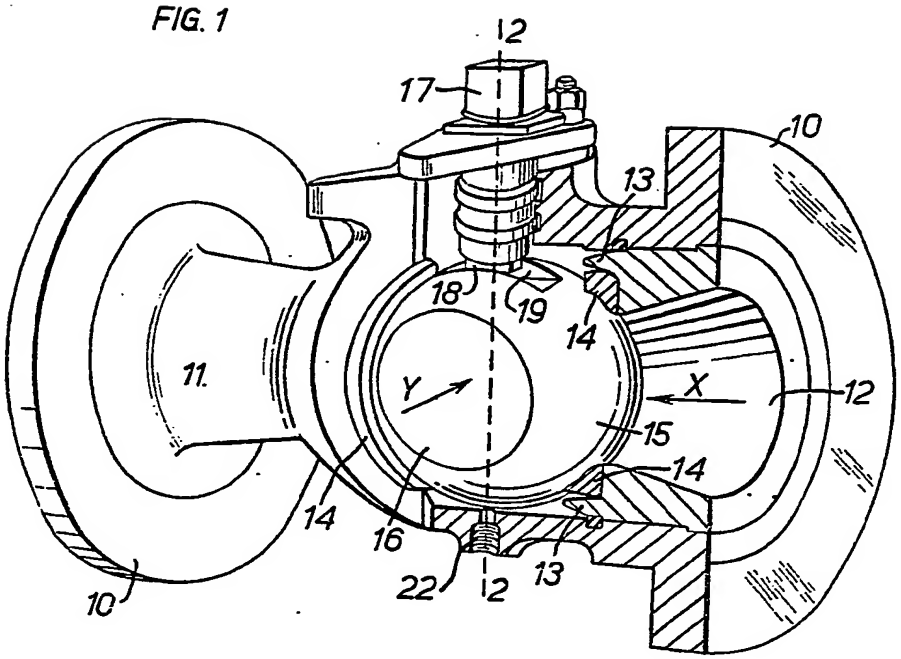
1 SHEET This drawing is a reproduction of the Original on a reduced scale

FIG. 1



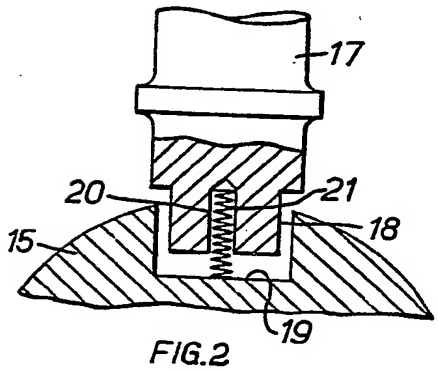


FIG.2

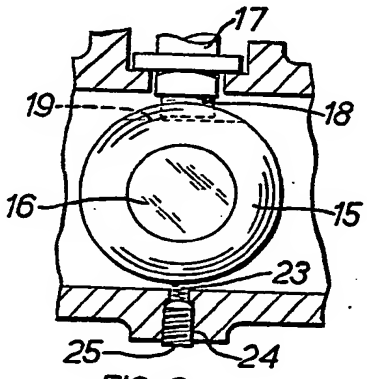


FIG. 3

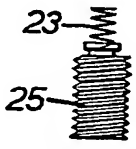


FIG. 4

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